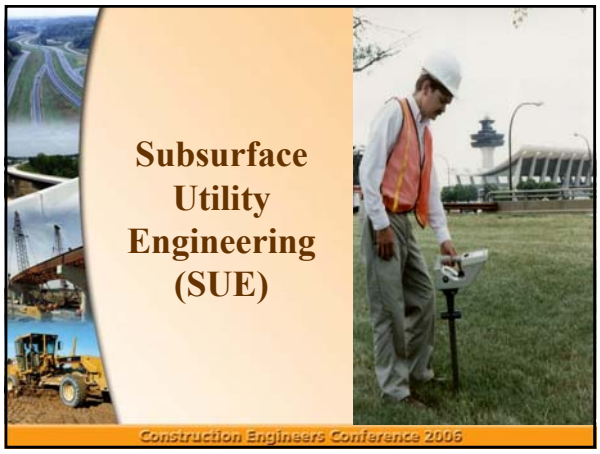
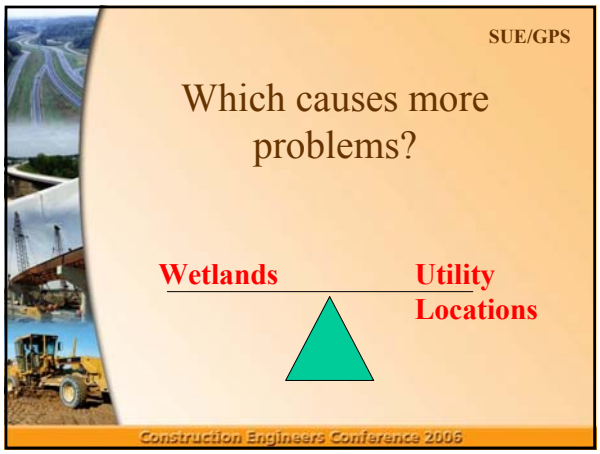
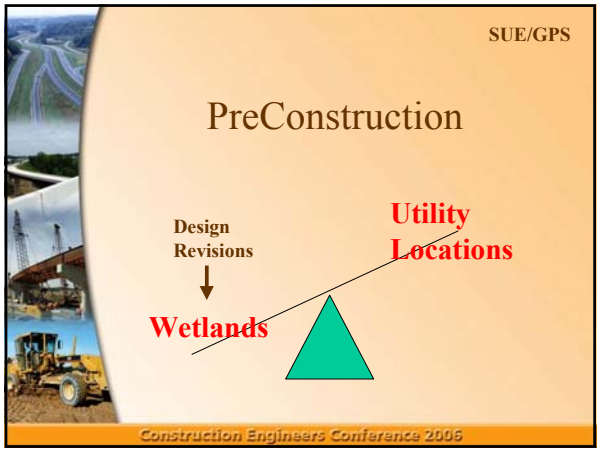
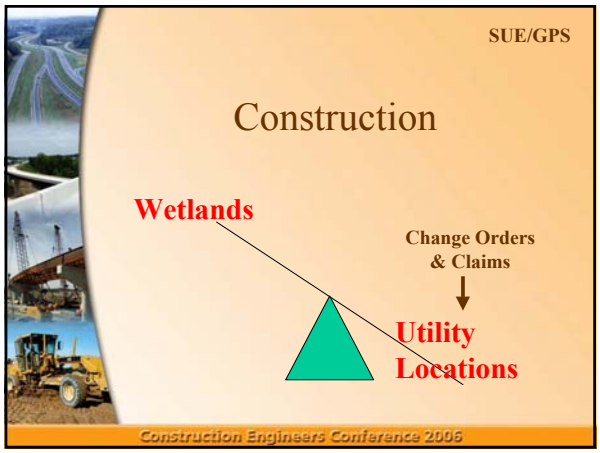
Construction Stakeout With GPS

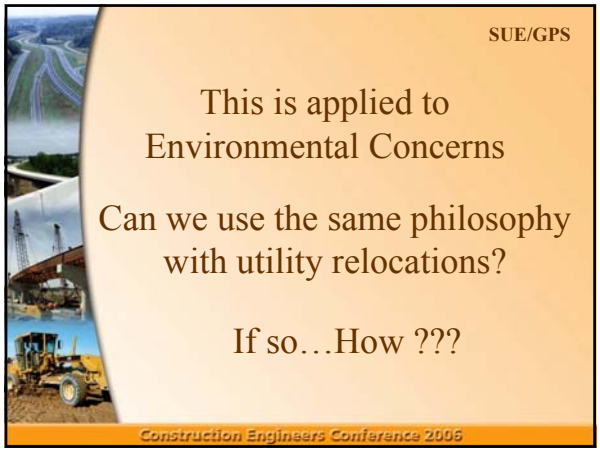


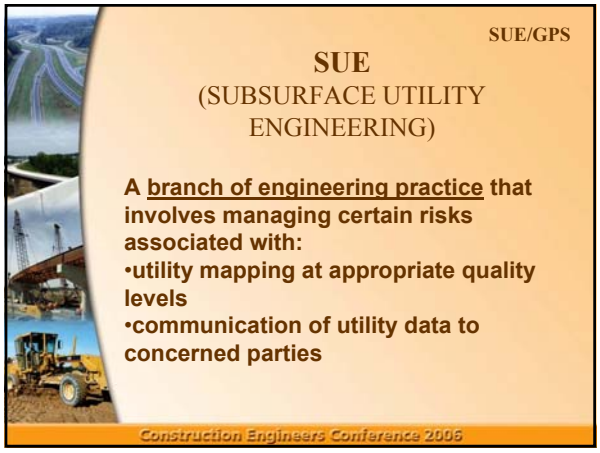


Construction Stakeout With GPS



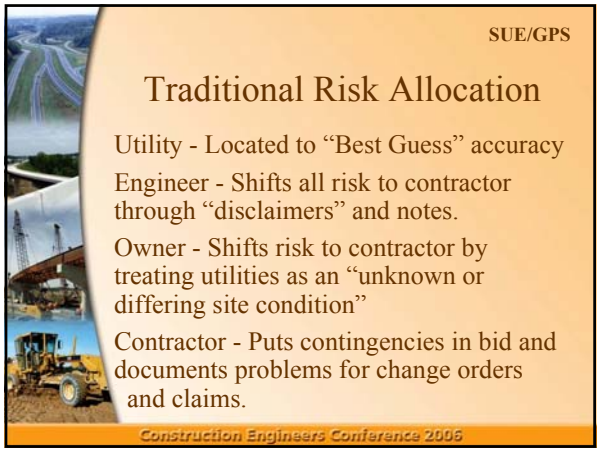



SUE/GPS
This is applied to Environmental Concerns
Can we use the same philosophy with utility relocations?
If so…How ???
Construction Engineers Conference 2006

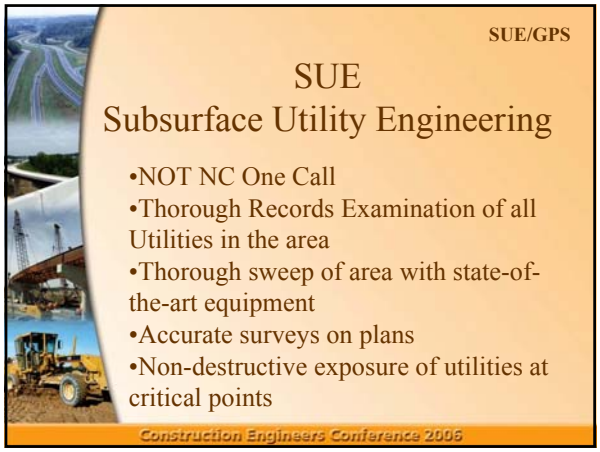

SUE/GPS
SUE
(SUBSURFACE UTILITY ENGINEERING)
A branch of engineering practice that involves managing certain risks associated with:
•utility mapping at appropriate quality levels
•communication of utility data to concerned parties
Construction Engineers Conference 2006

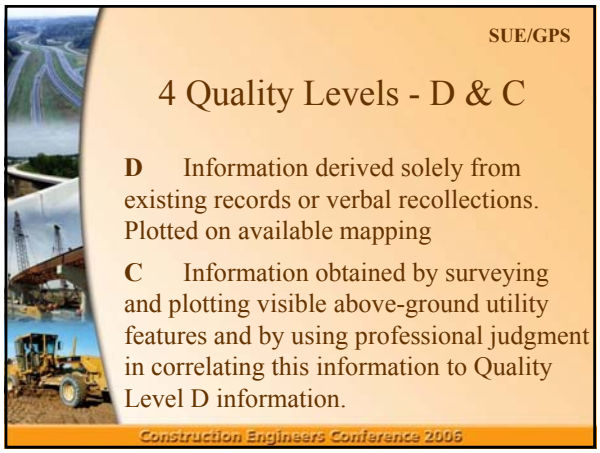

SUE/GPS
Basic Tenets of Highway Construction
Existing Utility Data as shown on plans consists of different "quality levels" - in other words, this data may be good, bad, or non-existent.
Traditional engineering practice is to depict all data the same, regardless of how good it may be known to be, and to disclaim any responsibility.
Construction Engineers Conference 2006

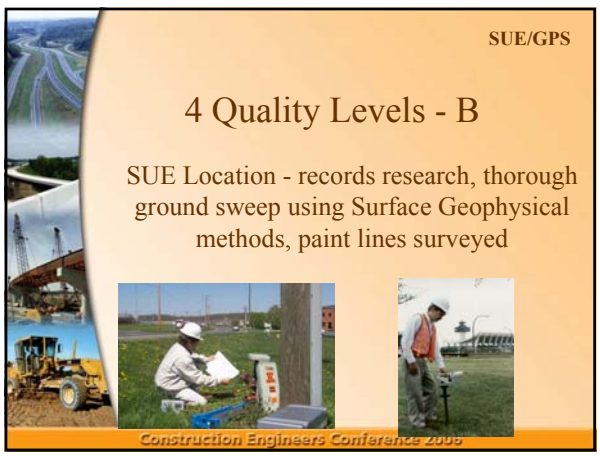
Construction Stakeout With GPS



Construction Stakeout With GPS







Construction Stakeout With GPS

SUE/GPS

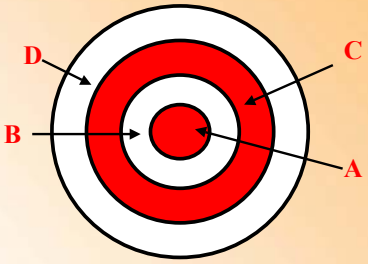
4 Quality Levels - A

Utility exposed using non-destructive vacuum excavation and surveyed

Construction Engineers Conference 2006

SUE/GPS

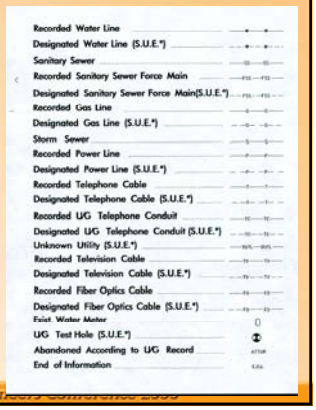
It's Like Zero-ing in on the data you need!



Construction Engineers Conference 2006

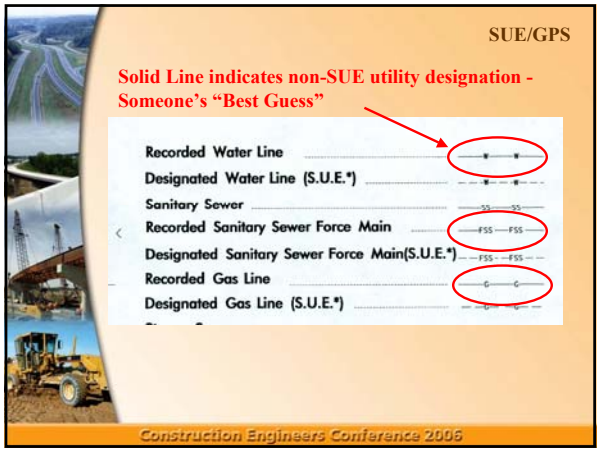
SUE/GPS

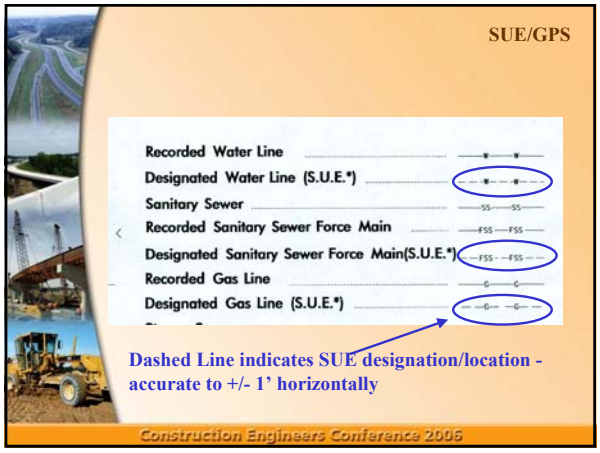
Plan Sheet Symbology Shows the Difference

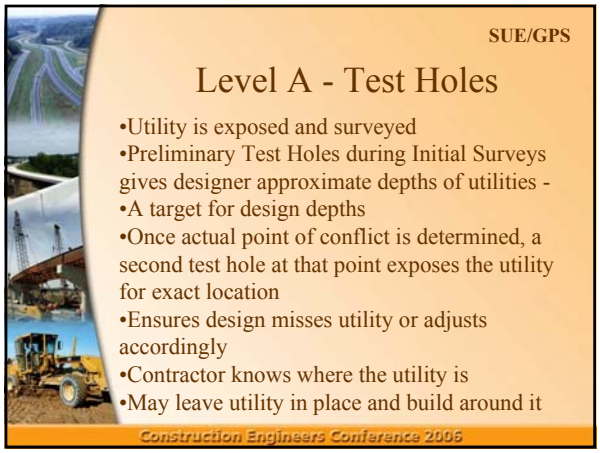


Construction Engineers Conference 2006

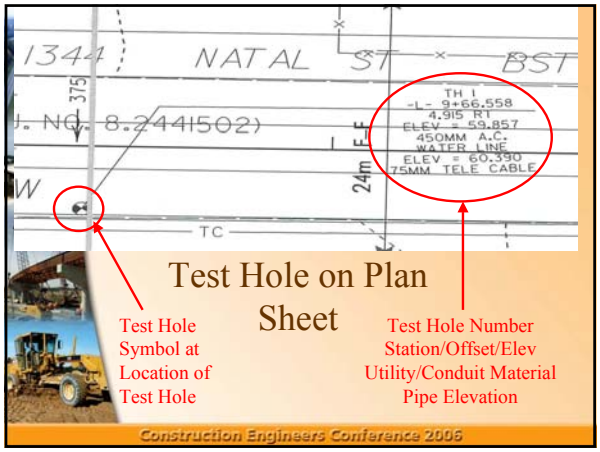
Construction Stakeout With GPS

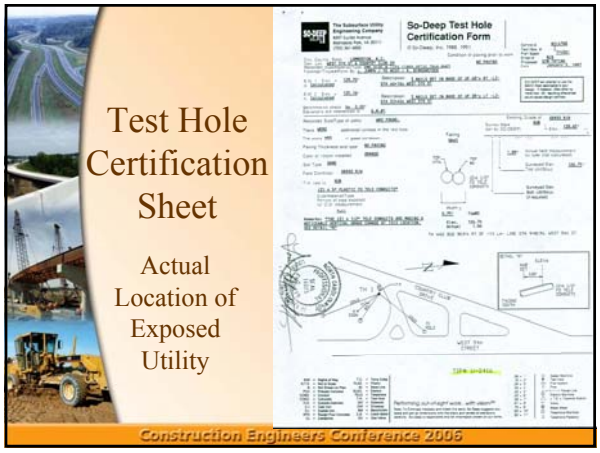


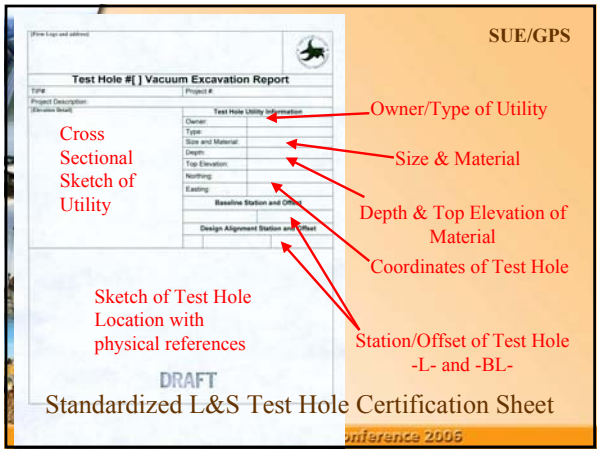




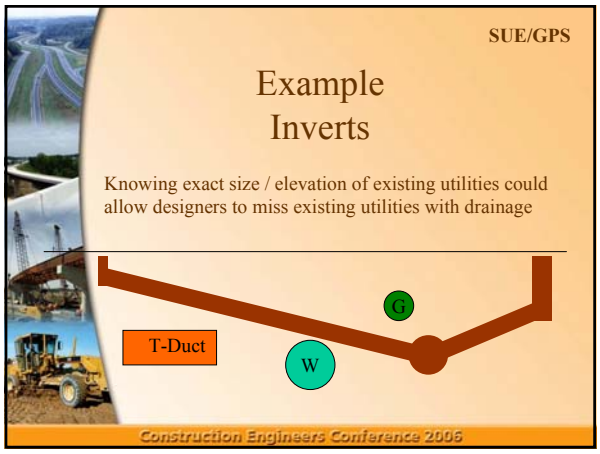
Construction Stakeout With GPS

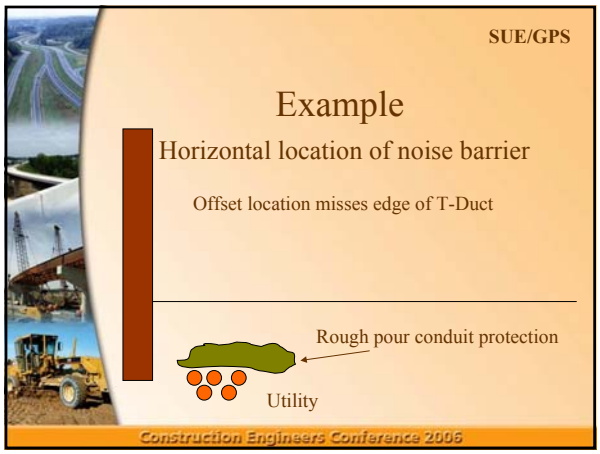




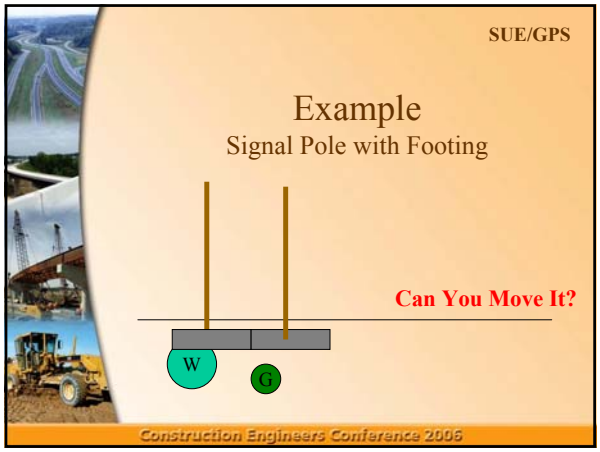


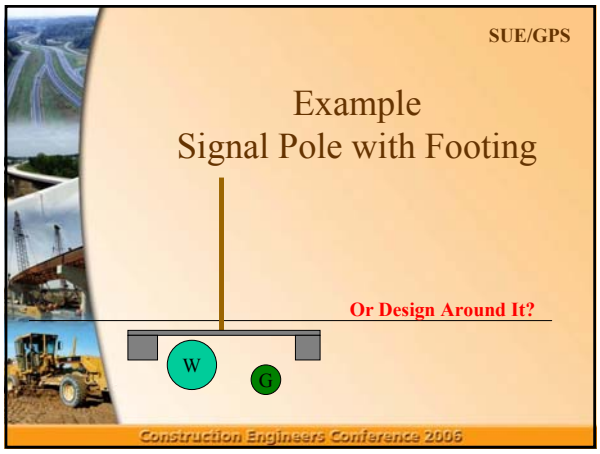
Construction Stakeout With GPS

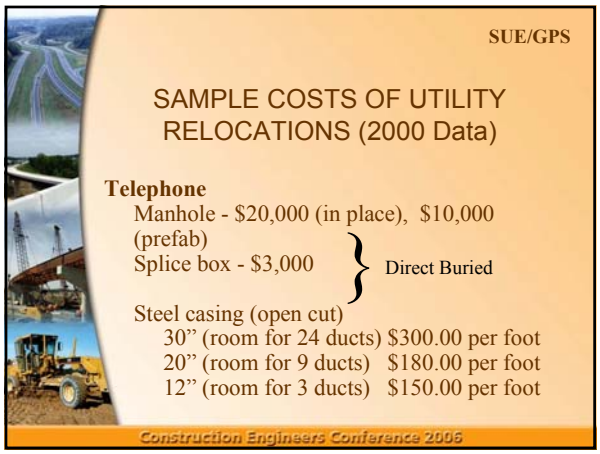




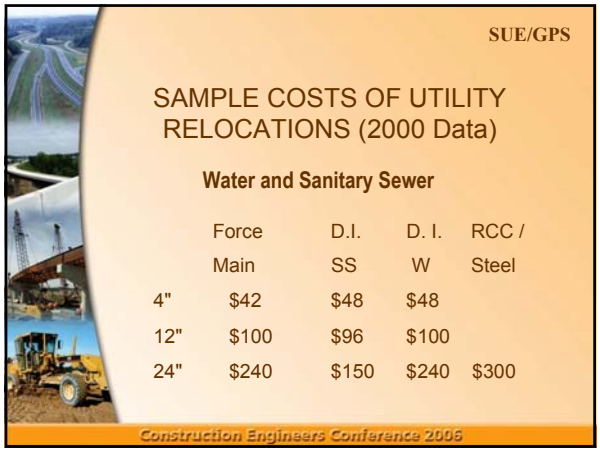
Construction Stakeout With GPS

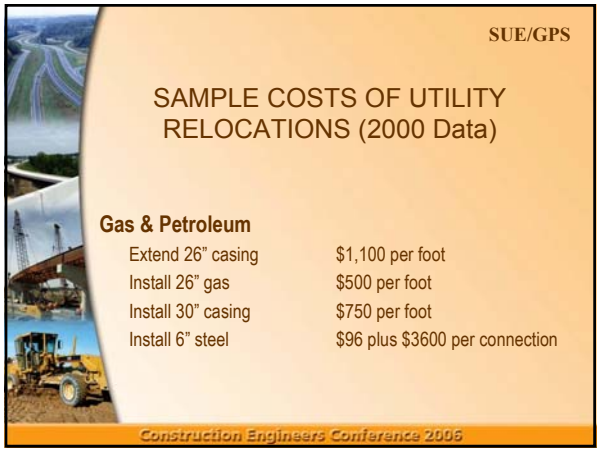


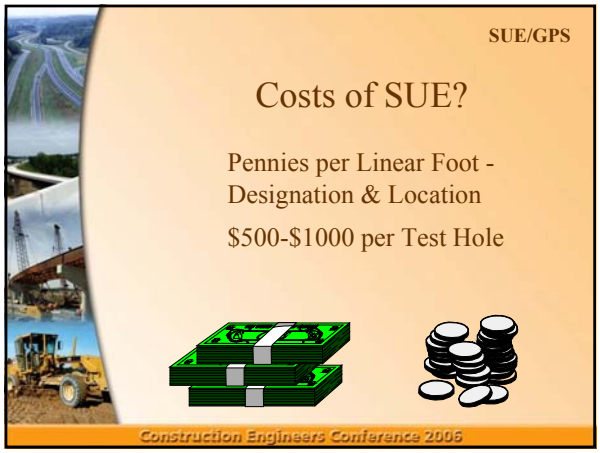




Construction Stakeout With GPS







SUE/GPS

Costs of Not Using SUE?

Each SUE Firm carries $1,000,000 Liability. This should cover re-design or most of the costs of delays and claims based on wrong identification or location.

Construction Engineers Conference 2006

SUE/GPS

A January 2000 FHWA / Purdue University study (Publication No. FHWA-IF-00-014) states the following:

"A savings of $4.62 for every $1.00 spent on SUE was quantified from a total of 71 projects. These projects had a combined construction value in excess of $1 billion. The costs of obtaining Quality Level "B" (QL B) and Quality Level "A" (QL A) data on these 71 projects were less than 0.5 percent of the total construction costs, and it resulted in a construction savings of 1.9 percent over traditional Quality Level C (QL C) and/or Quality Level D(QL D) data."

Construction Engineers Conference 2006

SUE/GPS

One individual project had a $206.00 to $1.00 return on investment (North Carolina DOT).

Only 3 of 71 projects had a negative return on investment. The simple conclusion of this study is that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and, when used in a systematic manner, will result in significant quantifiable and qualitative benefits.

Construction Engineers Conference 2006

Construction Stakeout With GPS

SUE/GPS

What Data is Available? Where?

- Data should be on plans
- L&S Staff should contact Resident prior to Preconstruction Meeting
- We'll pass on hard copies of Test Hole Certifications
- Also seeking ways to place this data on a server for your access, with web address on plans

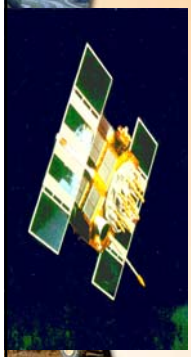
Construction Engineers Conference 2006

Global Positioning System (GPS)

Construction Engineers Conference 2006

SUE/GPS

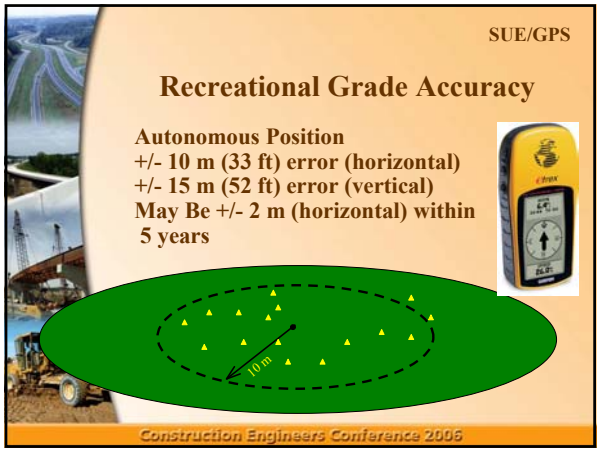
What Is GPS?

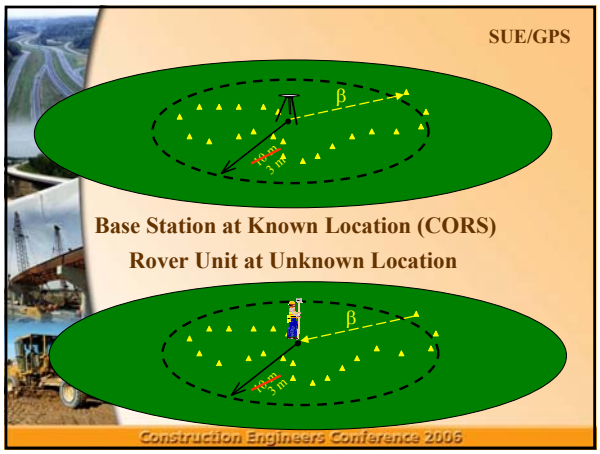


- 32 satellites in a fixed height orbit, with known location
- Transmitting a signal to a receiver on the ground. This signal is basically a time stamp
- Receiver on the ground measures the time required for the signal to go from sender to receiver
- Distance = Time/Speed of Light
- Minimum 4 satellites to give good position (Three circles define one point - 4th provides time check)
- Survey grade receivers can receive more signals for very accurate location

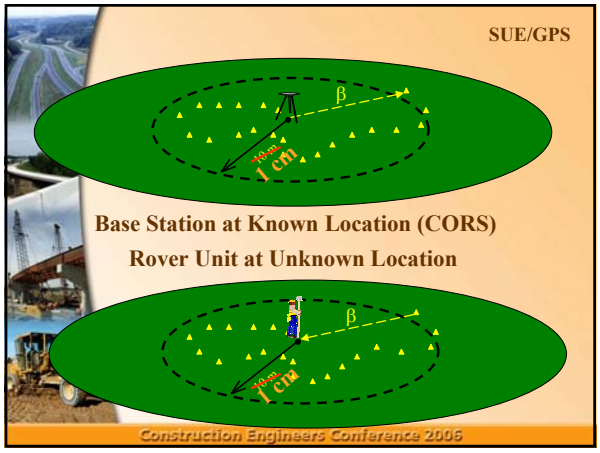
Construction Engineers Conference 2006

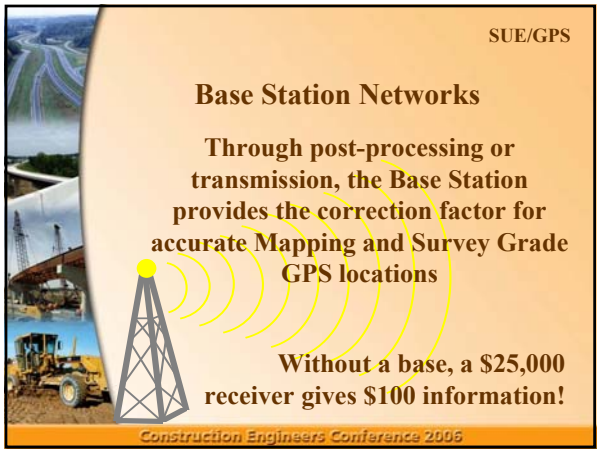
Construction Stakeout With GPS





Construction Stakeout With GPS





Construction Stakeout With GPS

Tools of the Trade

RTK - Real Time Kinematic
Right Here
Right Now
No Going Back
to the office to process data

Construction Engineers Conference 2006

SUE/GPS

Tools of the Trade - Base Stations

The Project-Specific Base
Local Control Possible
Provides Local Coverage
Limited Area
Requires Base and Transmitter/Receiver
Easy Set-up and Operation
Mobile
Owner-Operated

Construction Engineers Conference 2006

SUE/GPS

Tools of the Trade - Base Stations

CORS - Continuously Operating Reference Station
A permanently mounted base station providing data for a known reference point. This data maybe transmitted or recorded, or both.

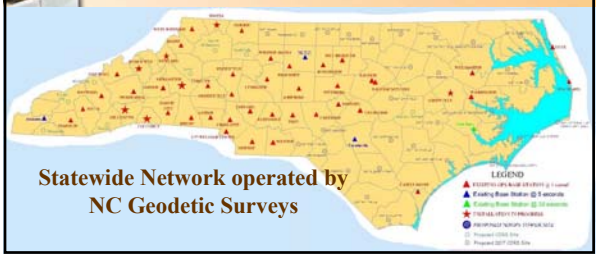
Tied to
HARN - High Accuracy Reference Network
A network of extremely accurate reference points, nationwide

Construction Engineers Conference 2006

Construction Stakeout With GPS

SUE/GPS

Base Station Networks - Survey Grade Existing NC CORS Stations



Statewide Network operated by NC Geodetic Surveys

SUE/GPS

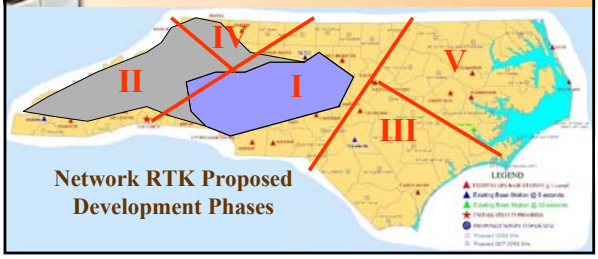
Tools of the Trade - Base Stations

- Virtual Reference System (Trimble)
- RTK Network Using Single or Multiple Base Stations
- More Accurate Correction Factor over Larger Area
- Transmits One Correction Factor to Multiple Rovers
- Utilizes Cell Phone Technology
- Stronger transmission signal for greater distance

Construction Engineers Conference 2006

SUE/GPS

Base Station Networks - Survey Grade NC Network RTK



Network RTK Proposed Development Phases

Construction Stakeout With GPS

SUE/GPS

Mapping Grade GPS in Construction: Estimating

- Paper plans and electronic alignment on a mapping grade GPS receiver

OR

- Electronic plans on a mapping grade GPS receiver

<u>No need to stake the project for estimation purposes</u>

Construction Engineers Conference 2006

SUE/GPS

Survey Grade GPS in Construction Stakeout

Same Control as used in Design
Tying Project & Photo Controls
Clearing & Grubbing
Construction Staking
Underground Utility Locations - Horizontal and Vertical (Exposed Utility)
Quick and Accurate
No Need for Traversing
Smaller Survey Crews

Construction Engineers Conference 2006

SUE/GPS

Survey Grade GPS in Construction Stakeout

- Coordinate Issues - Different Datums
- Tying Grid To Ground - How Do We Know What's Right?
- Good Communication - Design to Construction
- Equipment Calibration
- Control Data on Plans
- Electronic data transferred to contractor
- Must have knowledgeable users

Construction Engineers Conference 2006

Construction Stakeout With GPS

SUE/GPS

Survey Grade GPS in Vehicle Guidance/Machine Control

- Blades and Dozers
- Manual or Automatic
- Accurately position the blade (0.05' horizontal, 0.10' vertical)
- Everything tied to one project control network
- Allows use of digital terrain model

Construction Engineers Conf

SUE/GPS

Survey Grade GPS in Vehicle Guidance/Machine Control

- Faster, More Accurate
- Quantities - continuous measurement
- Line of sight not required
- Dramatically increases production (day/night)
- Dramatically reduces labor costs-layout,stakes

Construction Engineers Conf

SUE/GPS

Why Use Network RTK: Stake-Out or Vehicle Guidance

No Need for User-Owned Base Stations (Reduced Equipment Costs and Error)
Equipment and time cost savings
Reduces time and errors in setting up a base
Extended operating range with improved accuracy
All users in common, established co-ordinate frame
Eliminates the dependency on single base station (Back-ups should a reference station fail)
Uses established communications - cell phone

Construction Engineers Conference 2006

Construction Stakeout With GPS

SUE/GPS

NC Network RTK

- NC Geodetic Surveys is Network Administrator (NCDOT contributed seed money)
- Public/Private ($500 per rover 1-time fee)
- Network growth dependant upon available funds
- Additional Bases Stations required to completely cover NC
- Data Communication issues for NCDOT - Cell Phones

Construction Engineers Conference 2006

SUE/GPS

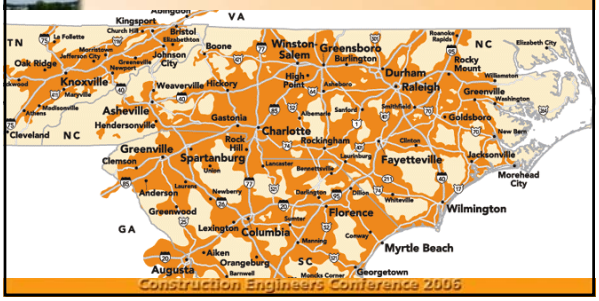
Equipment Needs

5700 RTK GPS System
(Base or Rover)
5800 RTK GPS Rover
TSCe Controller or
Trimble Recon Controller
Either w/ GeoPak …Maybe
Cellular Phone
(with Blue Tooth?)

Construction Engineers Conference 2006

SUE/GPS

Cingular Data Stream Coverage



Construction Engineers Conference 2006

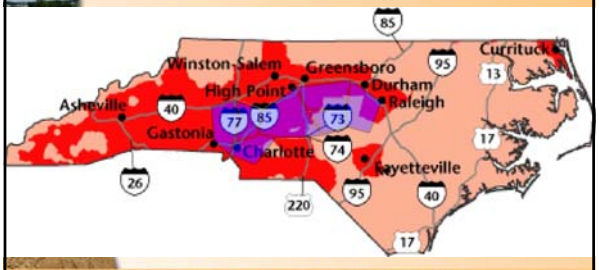
Construction Stakeout With GPS

SUE/GPS

Nextel Data Stream Coverage

SUE/GPS

Verizon Data Stream Coverage



Construction Engineers Conference 2006

SUE/GPS

Res. Engrs. with GPS Experience

Randy Midgette	Div 1 (Manteo)	(252) 331-4860
Chad Kimes	Div 2 (Greenville)	(252) 830-3495
Philip Johnson	Div 5 (Raleigh)	(919) 678-0444
Chris Kirkman	Div 7 (Greensboro)	(336) 334-3297
Ron Graham	Div 10 (Matthews)	(704) 847-5015
Larry Carpenter	Div 12 (Gastonia)	(704) 853-5381

Construction Engineers Conference 2006

Construction Stakeout With GPS